

CLAIMS

1. A compound represented by formula (I)



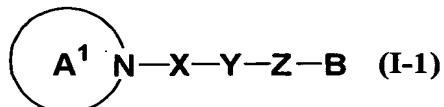
wherein A is a cyclic group which may have a substituent(s);

X, Y and Z are each independently a single bond or a spacer of which main chain has an atom number of 1-3; and

B is a hydrocarbon group which may have a substituent(s) or a cyclic group which may have a substituent(s),

a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof.

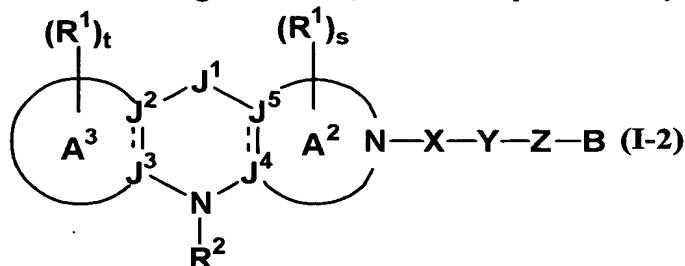
2. The compound according to claim 1, which is represented by formula (I-1)



wherein ringA¹ is a di-, tri-, or tetra-nitrogen-containing heterocyclic ring, the other symbols have the same meanings as those defined in claim 1, and wherein ringA¹ is not 2,3,4,5-tetrahydro-1H-1-benzazepine, 1,2,3,4,5,6-hexahydro-1-benzazepine, 2,3,4,5-tetrahydro-1,5-benzoxazepine, 6,7,8,9-tetrahydro-5H-pyrid[2,3-d]azepine or 5,6,7,8-tetrahydro-4H-thieno[3,2-d]azepine.

3. The compound according to claim 2, wherein ringA¹ is a tri-, or tetra-nitrogen-containing heterocyclic ring.

4. The compound according to claim 3, which is represented by formula (I-2)



wherein ringA² is a mono-nitrogen-containing heterocyclic ring;

ringA³ is a mono-carbocyclic ring or mono-heterocyclic ring;

plural R¹'s are each independently a substituent, and when R¹'s are plural, two R¹'s may be together to form cyclic group which may have a substituent(s);

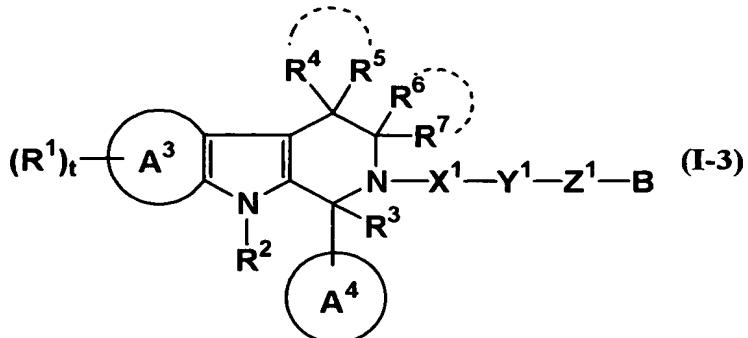
R² is a hydrogen atom or a substituent;

t and s are each independently 0 or an integer of 1-5, and the sum of t and s is 5 or less;

J¹ is a single bond, a carbon atom which may have a substituent(s), a nitrogen atom which may have a substituent(s), an oxygen atom or a sulfur atom which may be oxidized;

J^2 , J^3 , J^4 and J^5 are each independently a carbon atom or a nitrogen atom,
 ----- is a single bond or a double bond, and
the other symbols have the same meanings as those defined in claim 1.

5. The compound according to claim 4, which is represented by formula (I-3)



wherein R^3 , R^4 , R^5 , R^6 and R^7 are each independently a hydrogen atom or a substituent, and R^4 and R^5 , and/or R^6 and R^7 may be together with their binding carbon atom to form a cyclic group which may have a substituent(s);

ring A^4 is a cyclic group which may have a substituent(s);

X^1 and Z^1 are each independently a single bond, C1-3 alkylene which may have a substituent(s), C2-3 alkenylene which may have a substituent(s) or C2-3 alkynylene which may have a substituent(s);

Y^1 is $-C(=O)-$, $-C(=S)-$, $-C(=O)NR^{103}-$, $-SO_2-$, $-C(=O)O-$ or $SO_2NR^{103}-$, in which R^{103} is a hydrogen atom or a substituent,

the sum of the number of substituents represented by R^1 , R^3 , R^4 , R^5 , R^6 and R^7 is 4 or less, and

the other symbols have the same meanings as those defined in claim 1 or 4.

6. The compound according to claim 5, wherein R^4 and R^5 are simultaneously substituents, or R^4 and R^5 are together with their binding carbon atom to form a cyclic group which may have a substituent(s).

7. The compound according to claim 5, wherein R^3 is a substituent.

8. The compound according to claim 5, wherein R^6 and R^7 are simultaneously substituents, or R^6 and R^7 are together with their binding carbon atom to form a cyclic group which may have a substituent(s).

9. The compound according to claim 5, wherein R^3 is a mono-heterocyclic ring.

10. The compound according to claim 5, wherein B is a C3-10 mono-, or di-carbocyclic ring which may have a substituent(s) or a 3-10 membered mono-, or di-

heterocyclic ring which may have a substituent(s).

11. The compound according to claim 5, wherein ring A⁴ is a C3-10 mono-, or di-carbocyclic ring which may have a substituent(s) or a 3-10 membered mono-, or di-heterocyclic ring which may have a substituent(s).

12. The compound according to claim 5, wherein Y¹ is -C(=O)- or -C(=O)NR¹⁰³-.

13. The compound according to claim 4, which is selected from

- (1) N-(3,5-dimethylphenyl)-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (2) N-(3-methylphenyl)-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (3) N-(3,5-dimethylphenyl)-6-methoxy-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (4) 6-methoxy-N-(3-methylphenyl)-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (5) 6-methoxy-N-[2-(trifluoromethyl)phenyl]-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (6) N-(3,5-dichlorophenyl)-6-methoxy-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (7) 1-(3-fluorophenyl)-N-phenyl-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (8) 1-(3-fluorophenyl)-N-(3-methylphenyl)-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (9) N-(3,5-dimethylphenyl)-1-(3-fluorophenyl)-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (10) 2-acetyl-1-(3-fluorophenyl)-2,3,4,9-tetrahydro-1H-β-caroline,
- (11) 2-{[5-(trifluoromethyl)pyridin-2-yl]thio}acetyl)-2,3,4,9-tetrahydro-1H-β-caroline,
- (12) 2-{[(2,5-dimethoxyphenyl)thio]acetyl}-2,3,4,9-tetrahydro-1H-β-caroline,
- (13) 6-methoxy-1-(trifluoromethyl)-2-{[5-(trifluoromethyl)pyridin-2-yl]thio}acetyl)-2,3,4,9-tetrahydro-1H-β-caroline,
- (14) 2-{[(2,5-dimethoxyphenyl)thio]acetyl}-6-methoxy-1-(trifluoromethyl)-2,3,4,9-tetrahydro-1H-β-caroline,
- (15) 6-methoxy-N-(3-methylphenyl)-1-(trifluoromethyl)-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (16) N-(3,5-dimethylphenyl)-1-(3-fluorophenyl)-1,9-dihydrospiro[β-caroline-4,1'-cyclopropane]-2(3H)-carboxamide,
- (17) rac-(1R,3S)-N-(3,5-dimethylphenyl)-1-(3-fluorophenyl)-3-methyl-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (18) rac-(1R,3R)-N-(3,5-dimethylphenyl)-1-(3-fluorophenyl)-3-methyl-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (19) N-(3,5-dimethylphenyl)-1-(3-fluorophenyl)-6-(trimethylsilyl)-1,3,4,9-tetrahydro-2H-β-caroline-2-carboxamide,
- (20) N-(3,5-dimethylphenyl)-1-(3-fluorophenyl)-4,4-dimethyl-1,3,4,9-tetrahydro-2H-β-

carboline-2-carboxamide,

- (21) 2-acetyl-1-(3-fluorophenyl)-1,2,3,9-tetrahydrospiro[β -carboline-4,1'-cyclopropane],
- (22) 2-(benzylsulfonyl)-1-(3-fluorophenyl)-2,3,4,9-tetrahydro-1H- β -carboline,
- (23) rac-(1R,3R)-2-acetyl-1-(3-fluorophenyl)-3-methyl-2,3,4,9-tetrahydro-1H- β -carboline,
- (24) methyl 1-(3-fluorophenyl)-3,3-dimethyl-1,3,4,9-tetrahydro-2H- β -carboline-2-carboxylate, and
- (25) N-(3,5-dimethylphenyl)-8-(3-fluorophenyl)-5,6,8,9-tetrahydro-7H-pyrido[4',3':4,5]pyrrolo[2,3-b]pyridine-7-carboxamide.

14. A pharmaceutical composition comprising the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof.

15. The pharmaceutical composition according to claim 14, which is a preventive and/or therapeutic agent for a mitochondrial benzodiazepine receptor mediated disease.

16. The pharmaceutical composition according to claim 15, wherein the mitochondrial benzodiazepine receptor mediated disease is a disease caused by stress.

17. The pharmaceutical composition according to claim 16, wherein the disease caused by stress is a central nervous system disease caused by stress, a respiratory system disease caused by stress and/or a digestive system disease caused by stress.

18. The pharmaceutical composition according to claim 17, wherein the central nervous system disease caused by stress is anxiety-related disease, sleep disorder, depression and/or epilepsy; a respiratory system disease caused by stress is asthma; or the digestive system disease caused by stress is irritable bowel syndrome.

19. A preventive and/or therapeutic agent for a central nervous system, a respiratory system disease and/or a digestive disease, comprising the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof.

20. A pharmaceutical composition combining the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof, and one kind or more kind selected from antianxiety drugs, antidepressant drugs, antiparkinson drugs, therapeutic drugs for schizophrenia, antiepileptic drugs, therapeutic drugs for asthma, therapeutic drugs for peptic ulcer, adjustive drugs for gastrointestinal function, antidiarrheals, evacuants, antihypertensive drugs, antiarrhythmic drugs, inotropic drugs and therapeutic drugs for urination disorder.

21. A method for prevention and/or treatment for a mitochondrial benzodiazepine receptor mediated disease in mammals, which comprises administering to a mammal an effective amount of the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide, a solvate or a prodrug thereof.
22. Use of the compound represented by formula (I) according to claim 1, a salt thereof, an N-oxide thereof, a solvate thereof or a prodrug thereof for preparing a preventive and/or therapeutic agent for a mitochondrial benzodiazepine receptor mediated disease.